THE TOLLY GROUP

No. 206104 March 2006

Fortress Technologies, Inc.

Fortress Security Controller FC-*X*

Encryption and Compression Performance Evaluation of Three Models (FC-1500, FC-500 and FC-250)

TOLLY 17 YEARS 1989-2006 Test Summary

Premise: Wireless networks are getting faster and enterprise deployments are becoming more widespread. It is imperative that security tools for WLAN and fixed wireless deployments keep pace by offering high throughput, even when security controls for authentication and encryption are enabled. Users need to be aware of the impact that authentication and encryption capabilities have on overall network performance. Users should also understand the benefits of Layer 2 security for wireless networks.

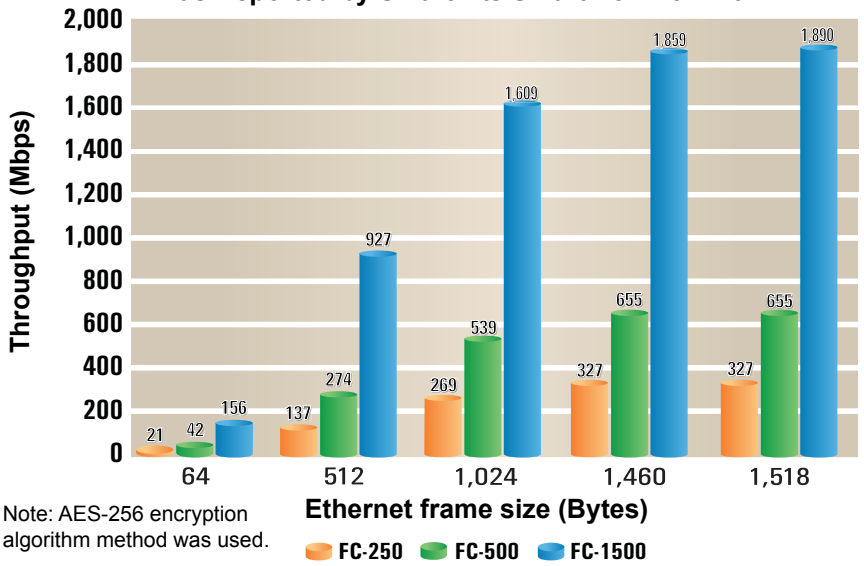
Fortress Technologies commissioned The Tolly Group to evaluate the performance of the company's flagship FC-*X* Security Controller. The Fortress FC-*X* is a high-performance security appliance with Gigabit Ethernet interfaces and is an integral part of the Fortress Security System designed to provide high performance, secure and reliable connectivity to wireless LANs and fixed wireless networks using Wi-MAX, free space optics, satellite, or other point-to-point links. The FC-*X* is placed between the wireless access points or bridges and the rest of the network infrastructure and all critical security operations – encryption, authentication, data integrity checking, key exchange and data compression – are optimized for minimal hands-on management.

The Tolly Group conducted steady-state zero-loss (≤ 0.001%) encryption and compression throughput and latency tests in two FC-*X* boxes, in a back-to-back configuration for 64-, 128-, 256-, 512-,

Test Highlights

- Delivers up to 1.89 Gbps, 657 Mbps and 328 Mbps of bidirectional encryption and compression throughput for FC-1500, FC-500 and FC-250 models respectively when handling compressible data type and a single client
- Achieves up to 1.8 Gbps, 656 Mbps and 327 Mbps of bidirectional encryption and compression throughput for FC-1500, FC-500 and FC-250 models respectively when handling compressible data type and maximum clients
- Provides up to 1.33 Gbps, 653 Mbps and 327 Mbps of bidirectional encryption and compression throughput for FC-1500, FC-500 and FC-250 models respectively when handling non-compressible data type and a single client
- Delivers up to 1.23 Gbps, 655 Mbps and 327 Mbps of bidirectional encryption and compression throughput for FC-1500, FC-500 and FC-250 models respectively when handling non-compressible data type and maximum clients
- Maintains between 37 and 74 microseconds of average latency at 95% of the bidirectional maximum throughput rate for all frame sizes for a FC-1500 model when handling non-compressible data type and a single client

Zero-loss (≤0.001%) Encryption and Compression Throughput For Compressible Data Type and a Single Client
as Reported by SmartBits SmartFlow ver. 4.6



Note: AES-256 encryption algorithm method was used.

Source: The Tolly Group, January 2006

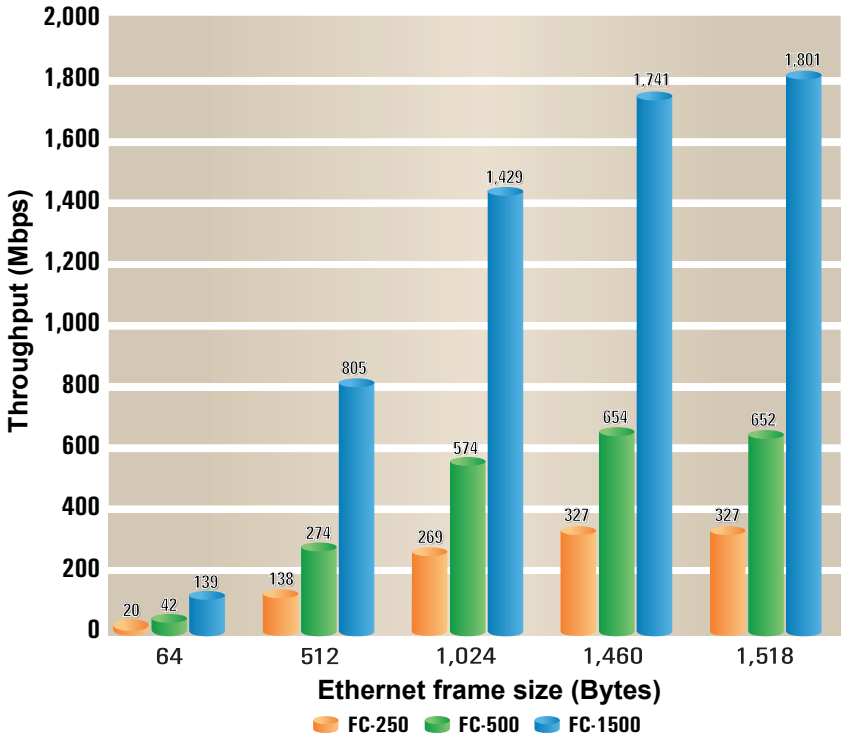
Figure 1

1,024-, 1,400- and 1,518-byte Ethernet frame sizes generated by Spirent Communications SmartBits SMB-600. The FC-*X* was subjected to extensive performance tests designed to measure the scalability of the FC-*X* Security Controller in three selectable performance modules: FC-1500, FC-500 and FC-250. All three modules are available on the FC-*X* platform, which can be upgraded via a simple license key.

The Tolly Group measured the zero-loss throughput in Mbps across the FC-*X* pair on an encrypted link for different data types (compressible traffic and non-compressible traffic) and various numbers of emulated clients for the three FC-*X* models. For the latency test, The Tolly Group measured the average Store-and-Forward latency for the non-compressible data type and a single client for the FC-1500 model only.

Tests were audited by Tolly Group engineers in January 2006 at Fortress Technologies facilities in Oldsmar, FL.

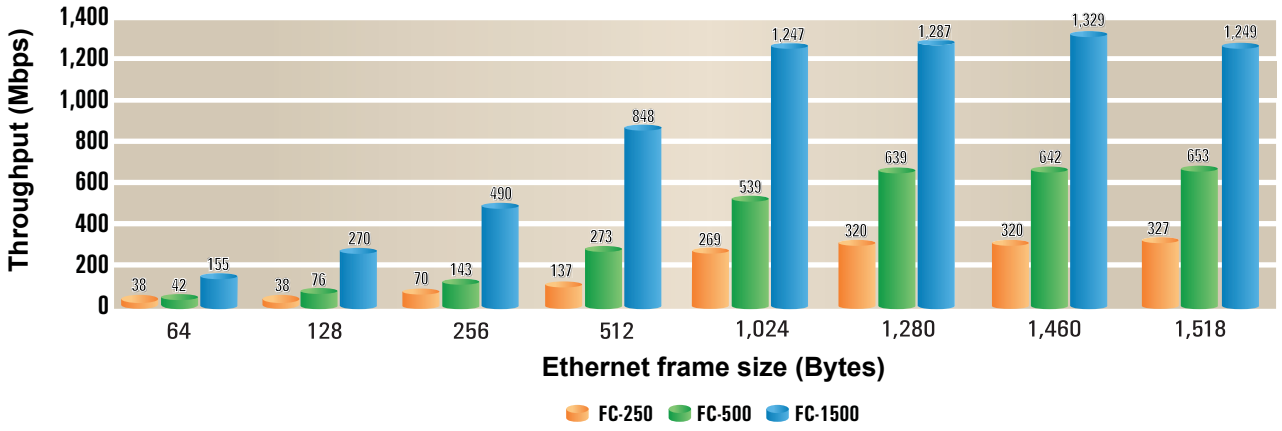
Zero-loss (≤0.001%) Encryption and Compression Throughput For Compressible Data Type and Maximum Clients
as Reported by SmartBits SmartFlow ver. 4.6



Notes: The number of emulated clients for FC-250, FC-500 and FC-1500 models were 500, 1,000 and 3,000 clients respectively. AES-256 encryption algorithm was used.

Source: The Tolly Group, January 2006 *Figure 2*

Zero-loss (≤0.001%) Encryption and Compression Throughput For Non-compressible Data Type and Single Client
as Reported by SmartBits SmartFlow ver. 4.6



Note: AES-256 encryption algorithm method was used.

Source: The Tolly Group, January 2006 *Figure 3*

Results

Throughput — Compressible Data Type and a Single Client

When handling the compressible data type and a single client, the Fortress FC-*X* achieved 1,890, 655 and 327 Mbps of bidirectional zero-loss (≤ 0.001%) throughput for 1,518-byte Ethernet frames across two FC-*X* appliances when configured as FC-1500, FC-500 and FC-250 models, respectively. (See Figure 1.)

For other frame sizes, the FC-1500 forwarded 156, 274, 506, 927, 1,609, 1,828 and 1,859 Mbps for 64-, 128-, 256-, 512-, 1,024-, 1,280- and 1,460-byte frames, respectively. The FC-500 forwarded 42, 76, 143, 274, 539, 657, 655 Mbps for the same set of frame sizes and the FC-250 recorded throughput of 21, 38, 70, 137, 269, 328 and 327 Mbps.

Throughput — Compressible Data Type and Maximum clients

When handling the compressible data type and maximum clients, the Fortress FC-*X* achieved 1,801, 652 and 327 Mbps of bidirectional zero-loss (≤ 0.001%) throughput for 1,518-byte frames across two FC-*X* appliances when configured as FC-1500, FC-500 and FC-250 models, respectively. (See Figure 2.)

For other frame sizes, the FC-1500 forwarded 139, 242, 447, 805, 1,429, 1,615 and 1,741 Mbps for 64-, 128-, 256-, 512-, 1,024-, 1,280- and 1,460-byte frames, respectively. The FC-500 forwarded 42, 75, 141, 274, 574, 656, 654 Mbps for the same set of frame sizes and the FC-250 recorded throughput of 20, 38, 70, 138, 269, 327 and 327 Mbps. Client streams of 3,000, 1,000 and 500 were used for the measurements for FC-1500, FC-500 and FC-250 models, respectively.

Throughput — Non-compressible Data Type and a Single Client

When handling the non-compressible data type and a single client, the Fortress FC-*X* achieved 1,329, 642 and 320 Mbps of the bidirectional zero-loss (≤ 0.001%) throughput for the 1,460-byte frames across two FC-*X* appliances when configured as FC-1500, FC-500 and FC-250 models, respectively. (See Figure 3.)

For other frame sizes, the FC-1500 forwarded 155, 270, 490, 848, 1,247, 1,287 and 1,249 Mbps for 64-, 128-, 256-, 512-, 1,024-, 1,280- and 1,518-byte frames, respectively. The FC-500 forwarded 42, 76, 143, 273, 539, 639, 653 Mbps for the same set of frame sizes above and the FC-250 recorded the throughput of 21, 38, 70, 137, 269, 320 and 327 Mbps.

Throughput — Non-compressible Data Type and Maximum clients

When handling the non-compressible data type and maximum clients, the Fortress FC-*X* achieved 1,232, 643 and 320 Mbps of the bidirectional zero-loss (≤ 0.001%) throughput for 1,460-byte frames across two FC-*X* appliances when configured as FC-1500, FC-500 and FC-250 models, respectively. (See Figure 4.)

For other frame sizes, the FC-1500 forwarded 136, 238, 430, 740, 1,108, 1,212 and 1,159 Mbps for 64-, 128-, 256-, 512-, 1,024-, 1,280- and 1,518-byte frames respectively. The FC-500 forwarded 42, 75, 142, 271, 539, 637, 655 Mbps for the same set of frame sizes and the FC-250 recorded the throughput of 20, 38, 70, 138, 269, 316 and 327 Mbps. Client streams of 3,000, 1,000 and 500 were used for the measurements for the FC-1500, FC-500 and FC-250 models, respectively.

Fortress Technologies, Inc.

Fortress Security Controller FC-*X*

Encryption and Compression Performance

TOLLY Up to Spec CERTIFIED

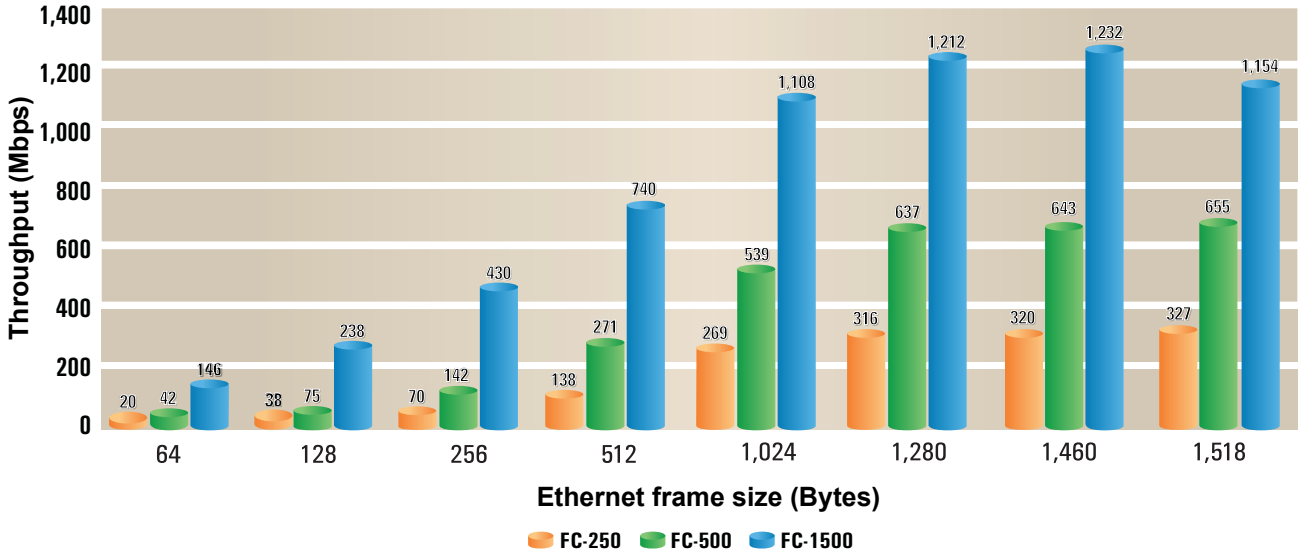
Fortress Technologies, Inc.
Fortress FC-*X* Security Controller
Product Specifications*

- Encryption
  - AES 128, 192, 256
- Multi-factor authentication options
  - network, device, user, guest, 802.1x
- User authentication options
  - RADIUS, LDAP, Active Directory, RSA SecurID
- Traffic prioritization
  - Five-level Class of Service
- Manageability
  - SNMP or Fortress MaPS
- VLAN support
  - Up to 4,096 VLANs
- Logging
  - Exportable to Syslog
- Form factor
  - 1U standard rack mount chassis
- Dimensions
  - 1.75"H × 17.5"W × 12"D (4.44cm × 44.45cm × 30.48cm)
- Weight
  - 11 lbs. (5 kg)
- System LCD
  - Two-line, 20-character, backlit LCD text display
- System LCD keypad
  - Four arrow keys for LCD menu navigation
- Safety
  - UL, CE markings per 60950-2
- Emissions
  - FCC Class B, EN55022
- Warranty
  - Ships with one year of maintenance and support

For more information contact:
Fortress Technologies, Inc.
4023 Tampa Road, Suite 2000
Phone: (813) 288-7388
Fax: (813) 288-7389
URL: *http://www.fortresstech.com*

**Vendor-supplied information not verified by The Tolly Group*

Zero-loss (≤0.001%) Encryption and Compression Throughput For Non-compressible Data Type and Maximum Clients
as Reported by SmartBits SmartFlow ver. 4.6



Notes: The number of emulated clients for FC-250, FC-500 and FC-1500 models were 500, 1,000 and 3,000 clients respectively. AES-256 encryption algorithm was used.

Source: The Tolly Group, January 2006

Figure 4

Latency — Non-compressible Data Type and a Single Client

When handling the non-compressible data type and a single client, the Fortress FC-*X* maintained an average latency between 37 and 74 microseconds for all frame sizes when the FC-*X* was configured as an FC-1500. (See Figure 5.) The FC-1500 exhibited average latency of 37, 39, 40, 46, 57, 61, 66 and 74 microseconds for 64-, 128-, 256-, 512-, 1,024-, 1,280-, 1,460-, and 1,518-byte frames, respectively.

Analysis

Results show that the FC-*X* delivers similar throughput when handling even the non-compressible data type and maximum number of clients it can support for each performance model. For the FC-500 or FC-250 models, the encryption and compression performance was fairly consistent for all frame sizes regardless of data types and the number of emulated wireless clients.

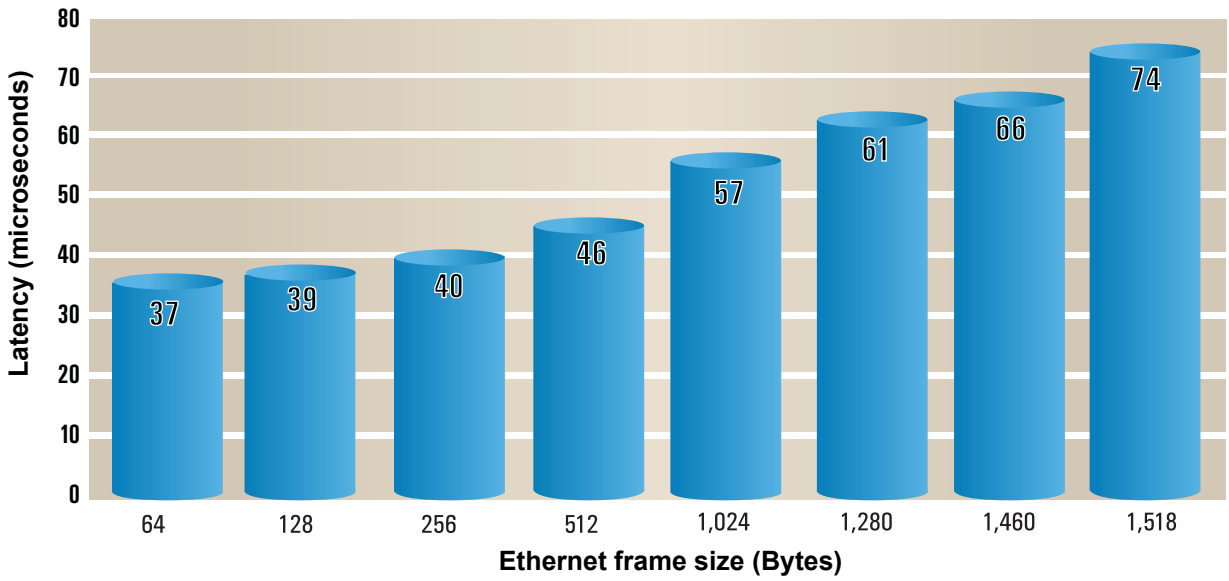
Configured as an FC-1500 model, the FC-*X* shows up to 30% throughput enhancement from the non-compressible data type to the compressible for larger frame sizes. In effect, the data type did not affect the performance for the smaller frame sizes in the FC-1500. The maximum degradation ratio associated with 3,000 emulated concurrent users was 12% for the smaller frame sizes. This is normal as the smaller frame sizes and large numbers of clients represents the most taxing processing scenario on the FC-*X*.

The test involving the compressible data type and a single client was a best-case test scenario and the non-compressible data type and multiple client test represented a worst-case test scenario. In these two distinctive deployment scenarios, the FC-*X* proved its robustness by maintaining performance even during the taxing worst-case scenario and still delivered significant throughput.

Latency measurements were recorded only for the non-compression data type and a single client when tested with an FC-1500 model. Test results show that FC-*X* processed (encrypting and compressing) the largest frame for 74 microseconds even at a high traffic load. The offered traffic load to measure the latency was 95% of the maximum zero-loss throughput measured from the throughput test. This proves that the FC-*X* processing frames at a high rate with low latency could satisfy rigorous demands for large VoIP deployments and rapidly growing applications in wireless networks. This resulted from Fortress' use of custom encryption hardware and advanced security processing technologies.

Since the FC-*X* supports three selectable performance modules in the same box, users can upgrade the system via a simple license key to cope

Average Latency (microseconds) for FC-1500 Model
For Non-compressible Data Type and a Single Client
as Reported by SmartBits SmartFlow ver. 4.6



Note: AES-256 encryption algorithm method was used.

Source: The Tolly Group, January 2006

Figure 5

with ever growing bandwidth needs without installing additional devices.

The FC-*X* is run in bridge mode and can be inserted into the existing network with no change required. This allows the FC-*X* not to tie to any particular vendors or RF protocols and in turn gives users the flexibility to modify networks as their wireless network requirements evolve.

Test Configuration and Methodology

The Tolly Group tested a Fortress Technologies, Inc. FC-*X* Security Controller equipped with four Gigabit Ethernet interfaces and running firmware version 4.0.

Engineers set up two FC-*X* appliances in a back-to-back configuration, connected by the single Gigabit Ethernet encrypted port from each FC-*X*. Engineers also connected a single Gigabit Ethernet unencrypted interface on each FC-*X* to the SmartBits Gigabit Ethernet port. A SmartBits 600 was used, (S/W: SmartFlow 4.60) equipped with two Gigabit Ethernet interfaces. (See Figure 6.)

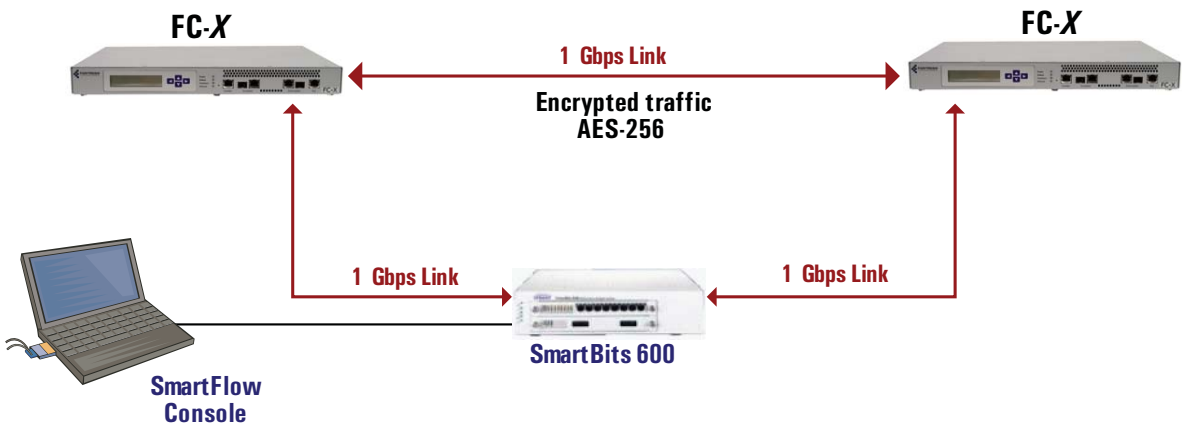
During prototype testing, an Ethereal packet analyzer sat in line to validate the encrypted traffic flow between FC-*X*s. For the throughput test, engineers first configured a pair of FC-1500 models and left the rest of the configuration as default. Using the Spirent SmartFlow, engineers generated bidirectional Ethernet traffic with specific data types and frame sizes across the encrypted link for a test duration of 60 seconds. Engineers set the SmartFlow's background data pattern to 'all zeros' for the compressible data type and to 'random' for the non-compressible. For the maximum clients test, engineers set up the multiple flows with different source MAC addresses using SmartFlow and verified the number of clients indicated in the LCD display of the FC-*X* before the production test. Engineers used the binary search algorithm of SmartFlow to determine the maximum zero-loss (≤ 0.001%) throughput. Each performance test was repeated three times and the results were averaged.

Upon completion of the test for FC-1500 model, engineers configured a pair of FC-500s and then FC-250s and performed the same tests as above.

For the latency test, engineers measured the Store-and-Forward latency using SmartFlow. The latency test was done only for the non-compressible data type and a single client on FC-1500 model. Traffic was generated at 95% of the maximum zero-loss throughput measured from the previous throughput test in the same configuration.

FORTRESS™ TECHNOLOGIES

Test Bed



Source: The Tolly Group, January 2006

Figure 8

The Tolly Group gratefully acknowledges the providers of test equipment used in this project.

Vendor	Product	Web address
Spirent Communications	SmartBits 600	http://www.spirentcom.com
Spirent Communications	SmartFlow 4.6	http://www.spirentcom.com

TESTED with SPIRENT

Terms of Usage

USE THIS DOCUMENT ONLY IF YOU AGREE TO THE TERMS LISTED HEREIN.

This document is provided, free-of-charge, to help you understand whether a given product, technology or service merits additional investigation for your particular needs. Any decision to purchase must be based on your own assessment of suitability.

This evaluation was focused on illustrating specific features and/or performance of the product(s) and was conducted under controlled, laboratory conditions and certain tests may have been tailored to reflect performance under ideal conditions; performance may vary under real-world conditions. Users should run tests based on their own real-world scenarios to validate performance for their own networks. Commercially reasonable efforts were made to ensure the accuracy of the data contained herein but errors and/or oversights can occur.

The test/audit documented herein may also rely on various test tools the accuracy of which is beyond our control. Furthermore, the document relies on certain representations by the sponsor that are beyond our control to verify. Among these is that the software/hardware tested is production or production track and is, or will be, available in equivalent or better form to commercial customers.

The Tolly Group provides a fee-based service to assist users in understanding the applicability of a given test scenario to their specific needs. Contact us for information.

When foreign translations exist, the English document is considered authoritative. To assure accuracy, only use documents downloaded directly from The Tolly Group's Web site.

Project Profile

Sponsor: Fortress Technologies, Inc.

Document number: 206104

Product class: Security gateway

Products under test:

- FC-*X* SW Ver 4.0

Testing window: January 2006

Software status:

- Generally available

For more information on this document, or other services offered by The Tolly Group, visit our World Wide Web site at http://www.tolly.com, send E-mail to sales@tolly.com, call (561) 391-5610.

The Tolly Group doc. 206104 rev. clk 01 Mar 06